

GLOBAL GEOLOGIC MAPPING OF IO: PRELIMINARY RESULTS. D.A. Williams¹, L.P. Keszthelyi², D.A. Crown³, P.E. Geissler², P.M. Schenk⁴, Jessica Yff², W.L. Jaeger², J.A. Rathbun⁵. ¹School of Earth & Space Exploration, Arizona State University, Tempe, Arizona 85287 (David.Williams@asu.edu); ²Astrogeology Team, U.S. Geological Survey, Flagstaff, Arizona; ³Planetary Science Institute, Tucson, Arizona; ⁴Lunar and Planetary Institute, Houston, Texas; ⁵Department of Physics, University of Redlands, Redlands, California.

Introduction: We are preparing a new global geologic map of Jupiter's volcanic moon, Io. Here we report initial results of our mapping: a preliminary distribution of material units in terms of areas (Table 1) and a visual representation (Figure 1). We also discuss some of the problems in Io geology we hope to address with the mapping.

Previous Work: During Year 1 of this project, we developed techniques for global mapping using a low-resolution *Galileo* regional mosaic [1]. During Year 2 (February 2006) we received our mapping base, a series of 1 km/pixel mosaics, produced by the USGS, from the combined *Galileo-Voyager* image data sets [2]. Global mapping has been done using ArcGIS™ software on the USGS mosaics. We have also begun production of an Io database [3] that will include most Io data sets to address the surface changes due to Io's active volcanism.

Results: Io's surface is dominated by plains material, thought to consist of Io's silicate crust covered by pyroclastic deposits and lava flows of silicate and sulfur-bearing composition. Many plains areas contain flow fields that cannot be mapped separately due to a lack of resolution or modification by alteration processes. Discrete lava flows and flow fields are the next most abundant unit, with bright (sulfur?) flows in greater abundance than dark (silicate?) flows. The source of most of Io's heat flow, the paterae, are the least abundant unit in terms of areal extent.

Table 1. Preliminary distribution of geologic units as percentage of Io.

Material Unit	Area (km ²)	Area (%)	Material Unit	Area (km ²)	Area (%)
Red-brown plains	1.41E7	33.4	Bright patera floors	1.84E5	0.4
Bright (yellow) plains	7.68E6	18.4	Dark patera floors	1.93E5	0.5
White plains	3.75E6	8.9	Undivided patera floors	6.75E5	1.6
Layered plains	1.84E6	4.4	Total Patera Floors	1.05E6	2.5
Region of poor resolution (Likely R-b plains)	7.20E5	1.7			
Total Plains	2.81E7	66.6	Bright lava flows	1.80E6	4.3
Lineated mountains	6.40E5	1.5	Dark lava flows	1.23E6	2.9
Mottled mountains	8.05E4	0.2	Undivided lava flows	8.70E6	20.6
Undivided mountains	5.54E5	1.3	Total Lava Flows	1.17E7	27.8
Tholi (domes)	5.25E4	0.1			
Total Mountains	1.33E6	3.1	Bright (yellow) diffuse dep.	8.76E5	2.1
			White diffuse deposits	2.90E6	6.9
			Red diffuse deposits	3.61E6	8.6
			Dark diffuse deposits	2.68E5	0.6
			Green diffuse deposits	4.09E3	0.01

Note: Diffuse deposits are superposed on all other materials, and cover 18.2% of Io's surface.

Future Work: Our immediate focus is to complete a draft map by end of July 2008. Upon completion of the draft map for peer review, we will use the new map to investigate several specific questions about the geologic evolution of Io that previously could not be well addressed, including: a) comparison of the areas vs. the heights of Ionian mountains to assess their stability and evolution; b) correlation and comparison of *Galileo* Near-Infrared Mapping Spectrometer (NIMS) and Photopolarimeter-Radiometer (PPR) hot spot locations with the mapped locations of dark vs. bright lava flows and patera floors to assess any variations in the types of sources for Io's active volcanism; and c) creation of a global inventory of the areal coverage of dark and bright lava flows to assess the relative importance of sulfur vs. silicate volcanism in resurfacing Io, and to assess whether there are regional concentrations of either style of volcanism that may have implications on interior processes.

References: [1] Williams, D.A. et al. (2007), *Icarus*, 186, 204-217. [2] Becker, T. and P. Geissler (2005), *LPS XXXVI*, Abstract #1862. [3] Rathbun, J.A. and S.E. Barrett (2007), *LPS XXXVIII*, Abstract #2123.

Figure 1 (next page). Preliminary global map of Io, in which the entire surface has been characterized into material units and structures. Diffuse deposits are also shown. The completed map is to be submitted to the USGS by end of July 2008.

